Summer 2017

Nanoplastic Settling Potential in Saline Environments

Zachary Smith
Montana Tech of the University of Montana, zsmith@mtech.edu

Katherine R. Zodrow
Montana Tech of the University of Montana, kzodrow@mtech.edu

Nanoplastic Settling Potential in Saline Environments

Zachary Smith and Katherine R. Zodrow
Environmental Engineering, Montana Tech, 1300 W. Park St. Butte, Montana

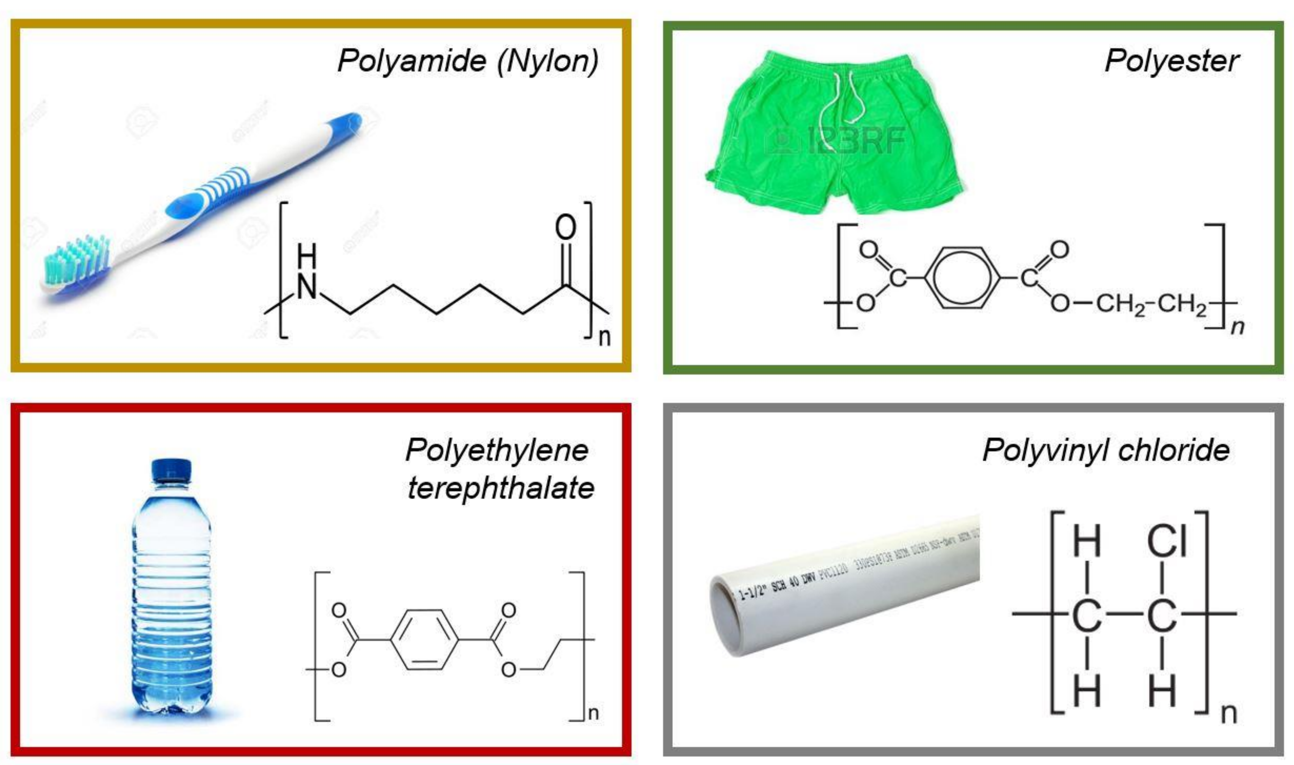
Background & Significance

- Nanoplastics are produced industrially for uses such as cosmetics and also generated by erosion of consumer plastic products.
- Nanoplastic properties are largely unstudied; understanding how these particles act will allow us to evaluate their environmental impact, design methods of detection and remediation.
- Microplastics bioaccumulate and adsorb harmful chemicals. Smaller nano-sized plastics may have an even higher affinity for chemical adsorption due to high surface areas, making these tiny particles a contaminant of emerging concern

Hypothesis

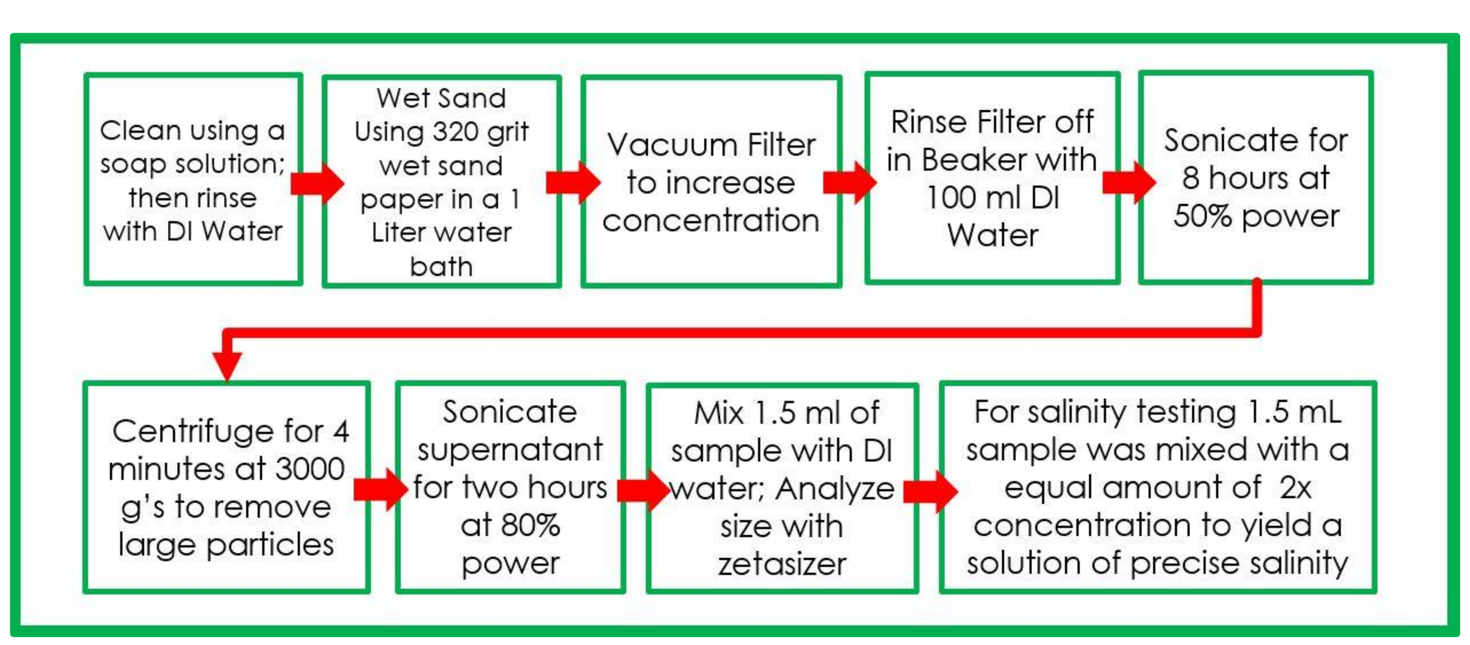
Nanoplastics produced by the erosion of larger plastics settle upon entry to the estuarine environment due to salinity-induced aggregation.

Plastics Tested



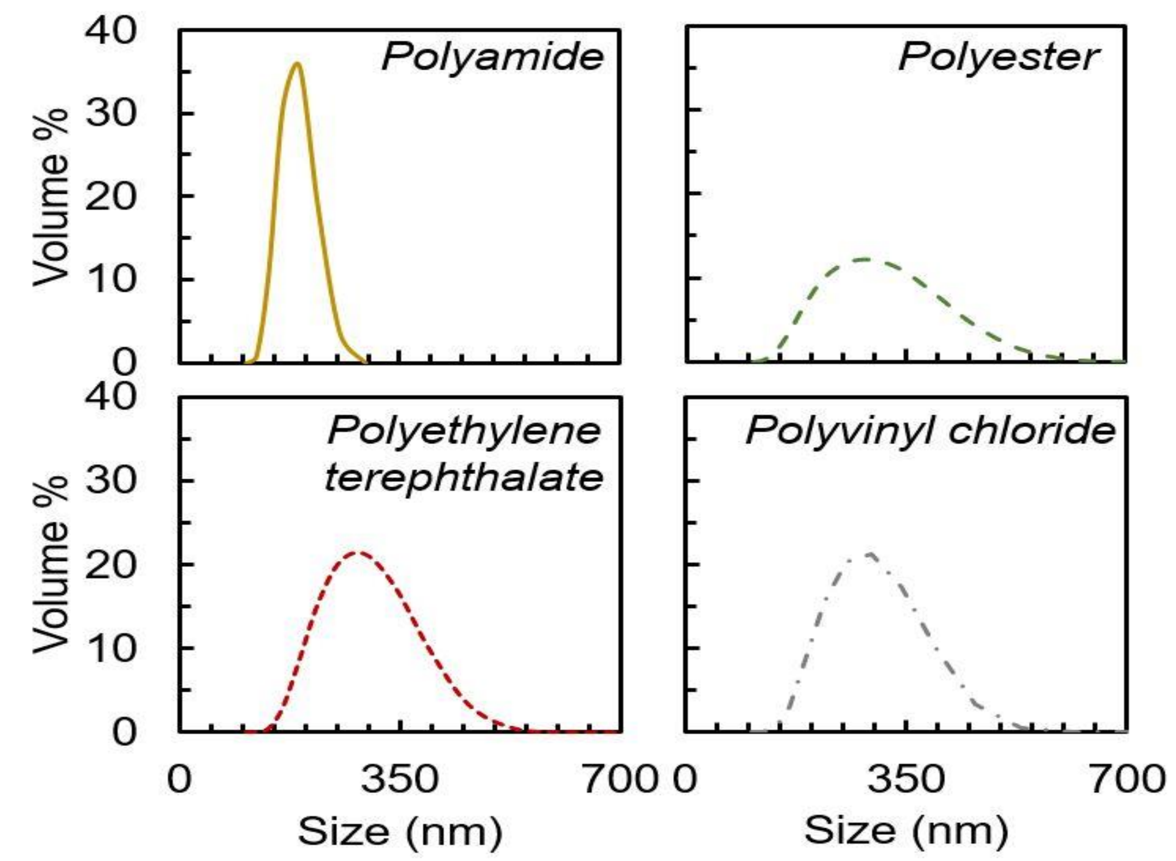
Methods

- Nanoplastics were produced through a process of sanding, filtering and sonicating.

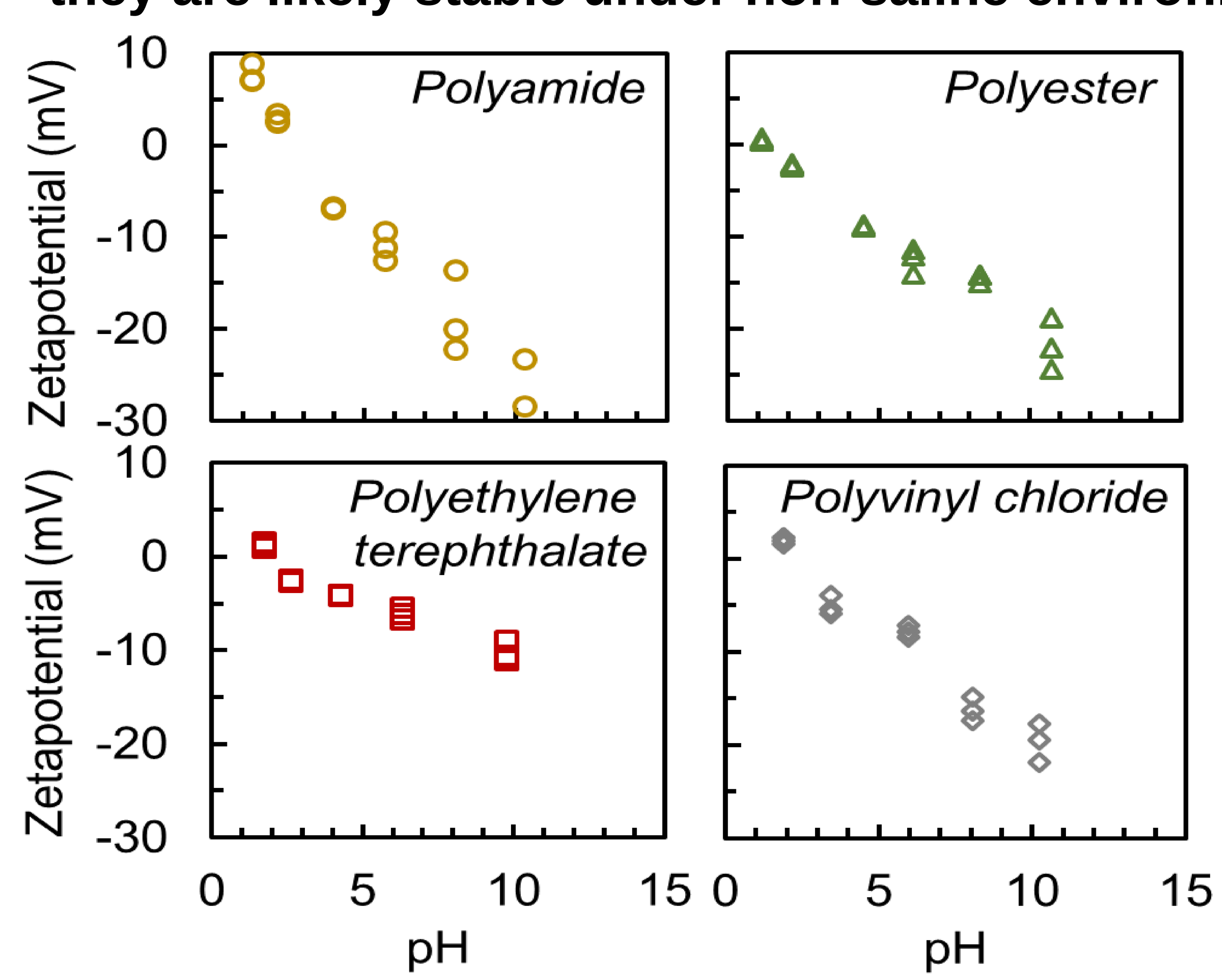


Results

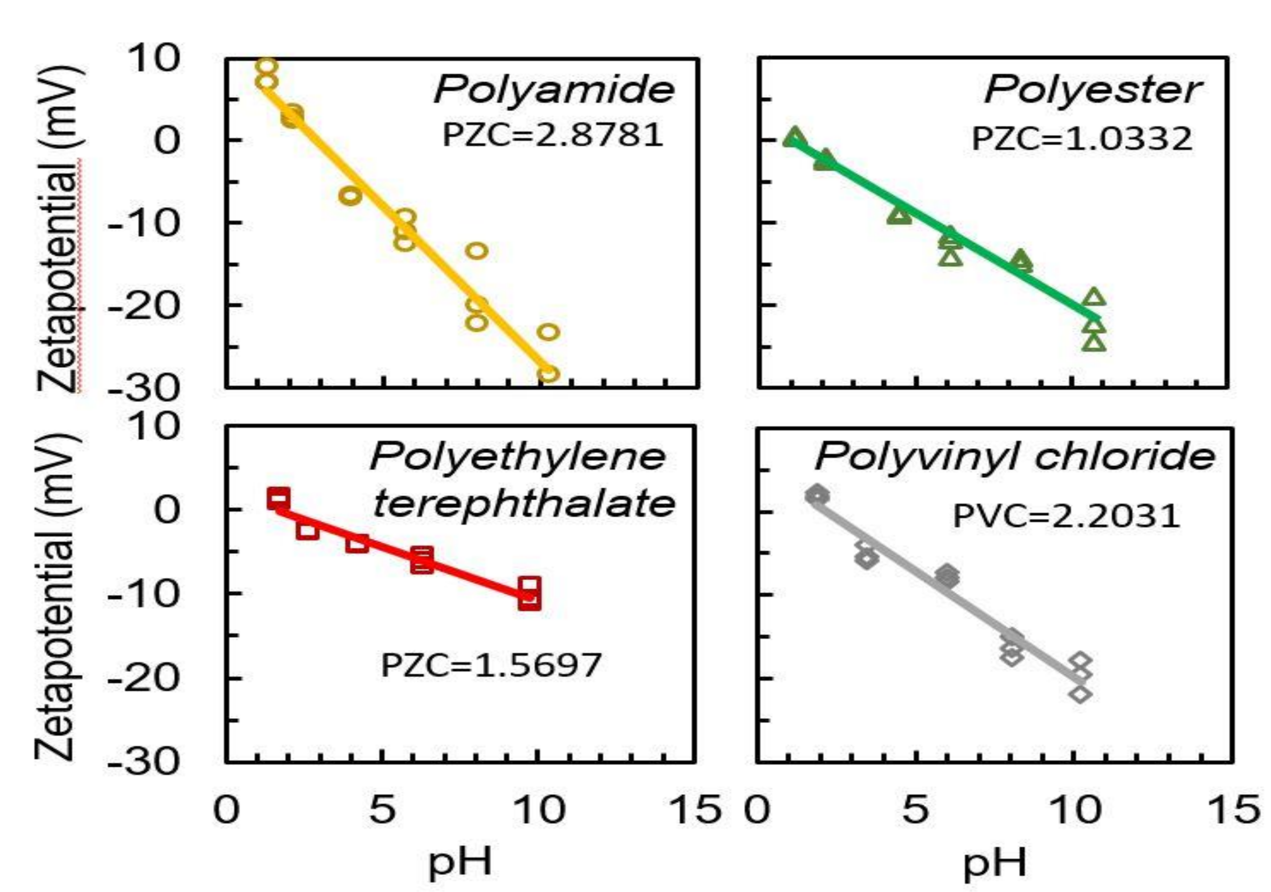
- Plastic nanoparticles produced by the sanding and sonicating process had a size range between 100 and 700nm



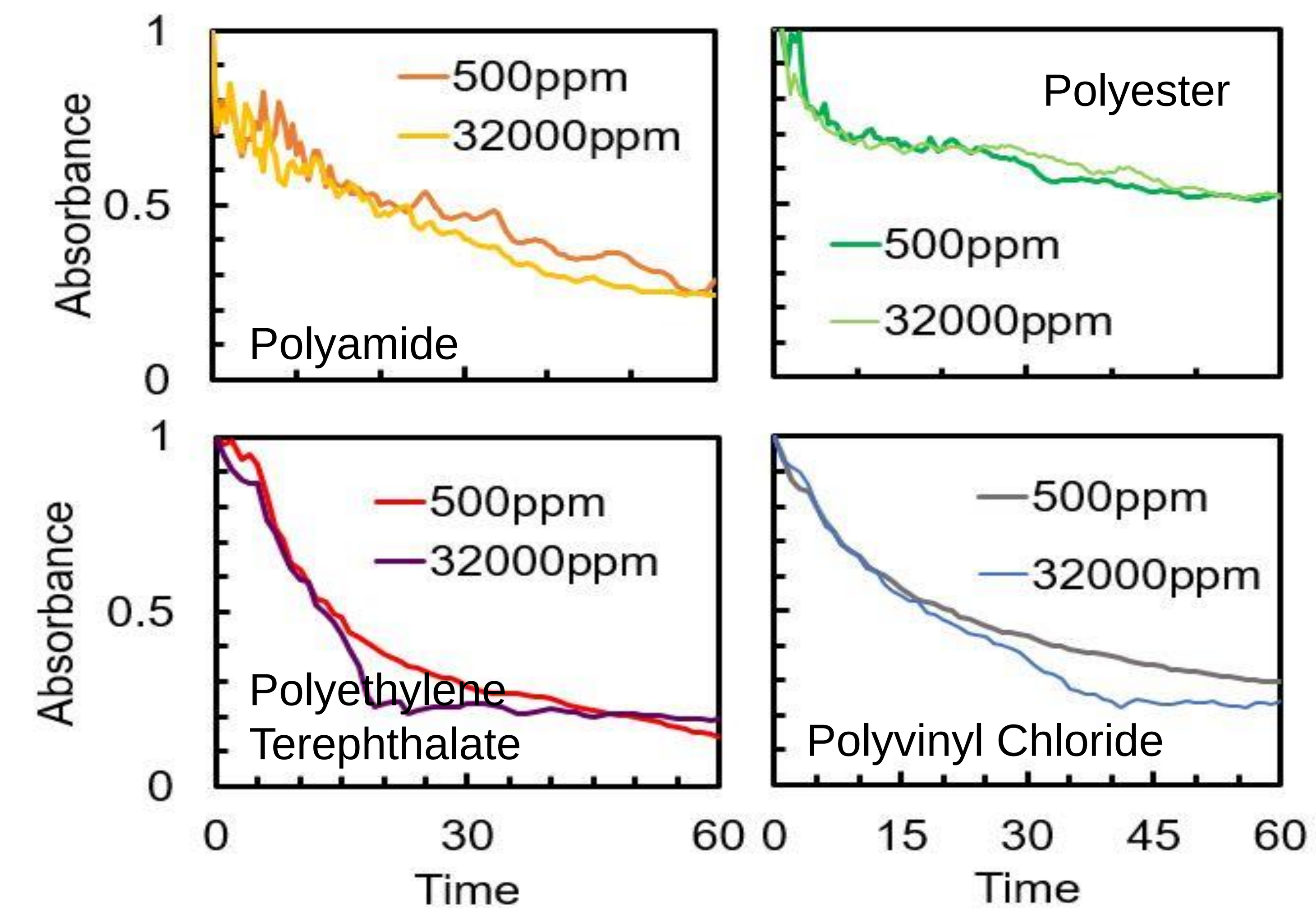
- As pH increased Zetapotential decreased. At pH ranges between 6 and 8 (the pH of natural environments) plastic particles exhibit negative zetapotentials thus they are likely stable under non-saline environments.



- The point of zero charge was determined for each sample.



The affect of Salinity on the settling rate of the plastics was investigated at salinities of 500ppm and 32,000ppm as salinity increased, settling rate increased.



Conclusion

1. Plastic settling appeared to increase for Polyethylene Terephthalate and Polyvinyl Chloride as salinity increased More testing is required to determine if results are statistically significant.
2. Plastics are affected by pH: as pH increases zetapotential also increases. This means that plastics are negatively charged at relevant pH and that they may be relatively stable at normal salinity.

Future work

- Further explore the effects of shape on physiochemical properties.
- Determine how water flow speed affects aggregation.
- Investigate nanoplastic concentrations present in natural environments.

Acknowledgments

This work was made possible by Montana Tech SURF. We would also like to thank Christina Eggensperger and Jordan Foster for help using various pieces of equipment. Special thanks to Malvern Customer Service for help with software issues as well as sending extra software packages.